CLAIMS:

1. A method for on-line cleaning of the internal surfaces of selected sections of a hydrocarbon fuel burning gas turbine, during operation, without significant loss of turbine power, comprising the steps of:

contacting the surfaces to be cleaned with a cleaning composition comprising particles ranging in size from about 0.01 to about 50,000 microns selected from the group consisting of graphite particles and molybdenum-based particles.

2. The method according to claim 1, wherein

said graphite particles are selected from the group of materials consisting of natural graphite, synthetic graphite, expandable graphite, non-expandable graphite and mixtures thereof.

3. The method according to claim 2, wherein

said graphite particles are formed of expandable graphite and are capable of expanding up to about 200 times their initial volume when heated above a predetermined temperature.

4. The method according to claim 1, wherein

said particles are formed of molybdenum-based compounds.

5. The method according to claim 1, wherein

said cleaning composition further comprises an oil soluble corrosion inhibitor selected from the group consisting of magnesium carboxylates, LMG-30E™, magnesium, cerium, zirconium, nickel, silicon, chromium, aluminum, barium, manganese, and iron, and mixtures thereof.

6. The method according to claim 5, wherein

said oil soluble corrosion inhibitor comprises a magnesium carboxylate having a minimum concentration of 25% magnesium.

7. The method according to claim 6 wherein

said contacting step comprises adding said cleaning composition into the fuel system of the turbine during operation thereof in a ratio of a minimum of 3 parts of magnesium to 1 part of vanadium in the fuel.

8. The method according to claim 5, wherein

said oil soluble corrosion inhibitor comprises LMG-30E™ having a minimum concentration of 30% magnesium.

9. The method according to claim 5, wherein

said cleaning composition comprises from about 1.0 wt % to about 3.0 wt % of said particles; and

from about 97 wt % to about 99 wt % of said oil soluble corrosion inhibitor.

10. The method according to claim 5, wherein

said cleaning composition further comprises an aromatic solvent.

11. The method according to claim 10, wherein

said cleaning composition comprises about 1.0 wt % of said particles;

about 15.7 wt % of said aromatic solvent; and

about 83.3 wt % of said oil soluble corrosion inhibitor.

12. The method according to claim 10, wherein

said cleaning composition further comprises a surfactant.

13. The method according to claim 12, wherein

said cleaning composition comprises about 1.0 wt % of said particles;

about 13.2 wt % of said aromatic solvent; and

about 2.5 wt % of said surfactant; and

about 83.3 wt % of said oil soluble corrosion inhibitor.

14. The method according to claim 1 wherein

said contacting step comprises periodically feeding said cleaning composition into the combustion section of the turbine during operation thereof

15. The method according to claim 14 wherein

said turbine is equipped with water wash nozzles in fluid communication with the combustion chamber of the turbine and said cleaning composition is fed into said combustion chamber through said water wash nozzles by pressurized air.

16. The method according to claim 1 wherein

said contacting step comprises periodically or continuously feeding said cleaning composition into the compressor section and hot gas section of the turbine during operation thereof by introducing it through the air intake downstream from the air filter with the inlet air to clean the compressor, and thereafter said cleaning composition continuing into the hot gas section of the gas turbine to clean the hot gas section.

17. The method according to claim 1 wherein

said turbine is equipped with an air conduit in fluid communication with the combustion chamber of the turbine and said contacting step comprises periodically or continuously feeding said cleaning composition into the combustion section of the turbine during operation thereof by injecting it into the combustion air through the air conduit, and thereafter said cleaning composition continuing into the hot gas section of the gas turbine to clean the hot gas section.

18. The method according to claim 1 wherein

the turbine exhaust is connected with downstream heat recovery equipment, including boiler tubes, in a co-generation or combined cycle system; and

said contacting step comprises feeding said cleaning composition into the turbine section to be cleaned by selectively introducing it either through the air intake downstream from the air filter with the inlet air to clean the compressor, or by injecting it into the combustion air through the air conduit, whereby said cleaning composition continues into the hot gas section of the gas turbine to clean the hot gas section and is mixed and transported in the turbine exhaust; and thereafter

conducting the exhaust and cleaning composition mixture through the boiler tubes at a velocity sufficient to impinge on, and clean, the interior surfaces of the boiler tubes.

19. The method according to claim 1 wherein

said contacting step comprises periodically feeding a charge of said cleaning composition into the turbine section to be cleaned for a period of time sufficient to effect evenly distributed flow, monitoring the actual power output and turbine exhaust temperature during this time period, and when no further increase in the power output or decrease in the turbine exhaust temperature is noted, discontinuing the cleaning sequence.

20. A cleaning composition for on-line cleaning of the internal surfaces of selected sections of a hydrocarbon fuel burning gas turbine and associated heat recovery equipment, during operation without significant loss of turbine power, comprising:

particles ranging in size from about 0.01 to about 50,000 microns selected from the group consisting of graphite particles and molybdenum-based particles.

21. The cleaning composition according to claim 20, wherein

said graphite particles are selected from the group of materials consisting of natural graphite, synthetic graphite, expandable graphite, non-expandable graphite and mixtures thereof.

22. The cleaning composition according to claim 21, wherein

said graphite particles are formed of expandable graphite and are capable of expanding up to about 200 times their initial volume when heated above a predetermined temperature.

23. The cleaning composition according to claim 20, wherein

said particles are formed of molybdenum-based compounds.

24. The cleaning composition according to claim 20, further comprising:

an oil soluble corrosion inhibitor selected from the group consisting of magnesium carboxylates, LMG-30E™, magnesium, cerium, zirconium, nickel, silicon, chromium, aluminum, barium, manganese, and iron, and mixtures thereof.

25. The cleaning composition according to claim 24, wherein

said oil soluble corrosion inhibitor comprises a magnesium carboxylate having a minimum concentration of 25% magnesium.

26. The cleaning composition according to claim 24, wherein

said oil soluble corrosion inhibitor comprises LMG-30E™ having a minimum concentration of 30% magnesium.

27. The cleaning composition according to claim 24, comprising:

from about 1.0 wt % to about 3.0 wt % of said particles; and

from about 97 wt % to about 99 wt % of said oil soluble corrosion inhibitor.

28. The cleaning composition according to claim 24, further comprising:

an aromatic solvent.

29. The cleaning composition according to claim 28, comprising:

about 1.0 wt % of said particles;

about 15.7 wt % of said aromatic solvent; and

about 83.3 wt % of said oil soluble corrosion inhibitor.

30. The cleaning composition according to claim 28, further comprising:

a surfactant.

31. The cleaning composition according to claim 30, comprising:

about 1.0 wt % of said particles;

about 13.2 wt % of said aromatic solvent; and

about 2.5 wt % of said surfactant; and

about 83.3 wt % of said oil soluble corrosion inhibitor.